AN ANALYSIS OF SOME OF THE FACTORS TO BE CONSIDERED IN EVALUATING SEASONAL PRICING PLANS FOR FEDERAL ORDER MILK MARKETS

by

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Fig. 1. The Greater Kansas City milkshed with locations of 74 sample farms in August, 1948.

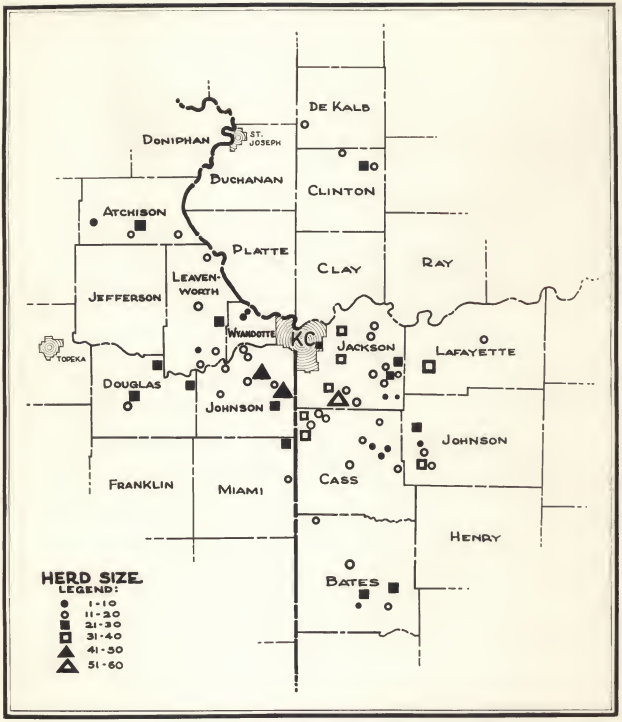

Fig. 2. The Greater Kansas City milkshed with 74 sample farms identified as to herd size, August, 1948.

INTRODUCTION

The wide variation in the seasonal production of milk is regarded by many authorities as one of the most important marketing problems in the Federal Order Milk Markets.[1] This variation in production has important effects on seasonal milk pricing, on marketing costs, and on the physical structure of the market area in fluid milk markets.

Most fluid milk markets receive their largest quantity of locally produced milk in the spring months and their smallest quantity of locally produced milk in the fall months. However, the market needs for Grade A milk fluctuate much less throughout the year than the production of milk. As a result pricing plans have been devised to encourage more even milk production to avoid surplus production in the spring months and deficit production in the fall months. It seems desirable for several reasons that the production of milk correspond as closely as possible to the market needs for Grade A milk if there are no fundamental trade barriers that restrict the flow of milk from various production areas and no restrictive controls are exercised by any of the market agencies.

Greater efficiency in the use of assembly and processing equipment and labor would result from more even milk

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[1] See Federal Milk Orders in Appendix.

production. In addition, studies in many areas[1] indicate that annual farm production costs of milk are lower under systems of farm management where production of milk more nearly conforms to market needs. However, studies in most areas are needed to determine the seasonal patterns of milk production that are most efficient for the various sizes of producing units and to determine what is the most efficient size of producing unit.

Under a competitive system of buying and selling it is assumed that the production of Grade A milk would be eventually adjusted to market needs by seasonal variations in price. However, there probably would be undesirable adjustments in the process. The problem under an administered pricing system has been to arrive at the proper seasonal variation in price to induce more fall production of milk and less spring production of milk and to still maintain an orderly marketing process. The basic long run economic objective of such a system should be to encourage the most efficient system of milk production on family sized farms and a marketing system that will provide milk to consumers at the lowest possible cost. This study is one of a series to be conducted in the Greater Kansas City Milk Market to determine some of the factors influencing farmers' response to pricing plans to encourage more level milk production.

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1 Factors Affecting Seasonal Milk Production and Their Effect on Producers' Costs and Returns, p. 36.

The Fall Production Premium Payment Plan, hereinafter referred as the Plan, was established in the Greater Kansas City Milk Market, May 23, 1946.[1] The purpose of the plan was to encourage more fall milk production and less spring milk production in the Kansas City Milkshed Area.[2] Twenty cents per hundred pounds of milk is deducted from each producer's receipts for each of the months of May, June and July. One-third of the total amount deducted for the above three months is paid back as a premium to producers during each of the months of October, November, and December. A separate fall premium check is sent to each producer during each of the pay-back months he is in the market. The amount of each producer's payment is proportionate to the amount his production is of the total market production for that month. The average annual net price received by producers during the period studied was $4.34 for 1946, $4.55 for 1947, and $5.25 for 1948.

It was difficult to ascertain by quantitative data on market milk receipts if the plan has been fully effective in bringing about more even milk production. Dairying was in a relatively unfavorable position compared with some other farming enterprises during the period under consideration. It was also difficult to isolate the effect of the plan on production

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[1] See Federal Milk Orders in Appendix.
[2] See Description of Area in Appendix.

response from the effects of seasonal variations in the "basic formula prices" and the seasonal variation in the "differential prices" that are added to the basic formula prices.

The incentive of the Plan differs from the incentive of seasonal price differences found in the basic formula price and the differential price and in the resultant blend price. The Plan is designed specifically to encourage adjustment of seasonal production of individual producers whereas the basic formula and differential prices are not. The basic formula price is a correlated price and the differential price is arrived at by bargaining between handlers and producers. Seasonal variations in the basic formula price and the differential price are determined by factors beyond the control of any one individual producer. Furthermore, the farmers' actual price is the blended price and this price is again determined by factors beyond the control of the individual farmer. Under the plan the individual farmer has some control over his net price to the extent that he varies his production to take advantage of the plan. By producing more fall milk relative to his spring production as compared with the market average he can raise the net price received for his milk.

GENERAL OBJECTIVES OF PRICING PLANS TO LEVEL SEASONAL MILK PRODUCTION

Plans to level seasonal milk production should have as their objective the most efficient use of area resources and the expansion of milk consumption. Many authorities[1] have pointed out that per capita consumption of milk has not reached the optimum level desired by nutritionists, therefore, the latter objective is a sound social and economic goal.

The consumption of milk for fluid use in any given market is relatively stable throughout the year while the natural tendency in the production of milk is to have a larger spring production relative to fall production. A practical appraisal of this fact would lead one to believe that there always will be more milk produced in the spring than in the fall in any given market. Therefore, if the demand factors are relatively stable one could expect a higher price to be paid for fall milk relative to spring milk.

Studies in many areas have shown that a production system favoring fall milk production will produce a larger volume of milk at a lower unit cost than a system of spring milk production.[2] In contrasting spring and fall systems of produc-

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1 What Makes the Market for Dairy Products?, p. 20.
2 Factors Affecting Seasonal Milk Production and Their Effect on Producers' Costs and Returns, p. 36.

ing milk the basic criteria for judgment from the standpoint of the producer should be: which system shows the greatest annual net profit?

It appears then that there is no basic conflict between producers, assemblers and processors in the leveling of seasonal milk production since a more even flow of milk would be advantageous to assemblers and processors as well as producers. Assemblers and processors must operate plants that have unused capacity during the fall and winter months. A plan that evens out production would permit a reduction in this excess capacity and would lower costs of operation.

If more even production of milk results in lower costs in the production and marketing of milk then a part of the gains should eventually be passed on to the consumer. This should expand the consumption of milk and milk products. A wider market for milk should benefit all agencies concerned.

REVIEW OF LITERATURE

For a review of literature on the subject of seasonal milk pricing the reader is referred to a comprehensive report made by an interregional committee on dairy marketing research. The committee includes representatives of the Agricultural Experiment Stations in the North Central States and the Northeastern States, and of the Bureau of Agricultural Economics, United States Department of Agriculture.

The committee's report was issued by the Northeast Agricultural Experiment Stations as Maine Agricultural Experiment Station Bulletin 459, April, 1948. The title of the bulletin is "Factors Affecting Seasonal Milk Production and their Effect on Producers' Costs and Returns." All the published material available on the seasonal problem at the time the report was being prepared has been summarized and presented in as condensed form as possible in this bulletin.

OBJECTIVES OF THIS STUDY

A broad comprehensive study of the problem of seasonal milk production would include the problems of consumers, producers, assemblers, processors, and distributors. Due to limited resources, this study was confined to the aspects of the problem of uneven milk production which directly concern the producer. The major concern was the impact of "seasonal pricing plans" on milk production costs. The fundamental reason to be concerned with the effect of seasonal pricing plans on costs of production is that plans that result in lower costs of producing milk should eventually be reflected in expanded consumption of milk.

SCOPE AND LIMITATIONS OF STUDY

The analysis of the 74 farms surveyed is not intended

to apply to the 2278 producers in the market at the time of the survey but only to the 1576 producers who had sold milk continuously during the take-out periods of 1946 and 1947. The 702 producers not included in the population sampled may be studied at a later date. Any conclusions derived from this study apply primarily to conditions similar to those at the time of the study. Considerable changes in the general level of economic activity could materially alter existing relationships.

Furthermore this study is not an evaluation of the theory of the Fall Production Premium Payment Plan but merely an attempt to more clearly isolate some of the basic factors that should be considered in evaluating such a plan.

It was assumed throughout this study that the only market outlet for the producer was the Federal Order market. The problem of a producer shipping only a part of his production at any given time was not analyzed, nor was the fact that some producers shift completely from market to market at various times of the year analyzed. Not taking these factors into consideration may be open to criticism; however, it was impossible to obtain the necessary information to include them in the analysis.

SAMPLING TECHNIQUE

Population Sampled

Since it was desired to trace the effects of the Plan on seasonal milk production patterns only those producers who had been on the market since the Plan was initiated were surveyed.

There were 2278 producers selling milk in the Greater Kansas City Milk Market at the time the survey was conducted in August, 1948. Of this number, 1576 marketed milk druing 1946 and 1947 when the Plan was in effect. Those who had not shipped milk continuously since the initial take-out period of May, June, and July, 1946 were excluded from the population to be surveyed. It was assumed that some time would be required to make adjustments to the Plan, if any were to be made. For this reason it seemed desirable to exclude those farmers who had not been on the market for at least two complete take-out and pay-back periods. It was also necessary to isolate the particular group of farms that had the same period of time for response to the Plan in order to obtain valid conclusions from analysis of the data used.

Sampling Procedure

The total population as defined in the above paragraph

was grouped into four major areas according to mailing address location. In each of these areas the farms were randomly listed and assigned consecutive numbers. A five per cent random sample of farms was then selected from each area by using a book of random numbers. Alternate sample farms were selected for each area in the same manner, before the actual interviewing began. The interviewers were instructed to make at least two attempts to interview the initial sample farm before proceeding to one of the alternate farms in that area.

Tests of Reliability of Sample

It is always important to know, if possible, how closely a sample of farms represents the total number of farms being sampled. In many studies it is not possible to make such comparisons. However, data on the total milk production of all farms being sampled were available after the survey of the sample farms was completed.

Since the study was primarily concerned with seasonality of milk production a comparison was made of the seasonal indices of the sample farms and the entire population sampled for both 1946 and 1947.

The means and standard deviations of the seasonal indices of the population and samples for 1946 and 1947 are as follows:

	1946		1947	
	Population	Sample	Population	Sample
Arithmetic Mean	138.2	137.7	168.7	167.0
Standard Deviation	55.1	68.1	77.0	74.8

The seasonal indices used were calculated by computing the per cent that production in the take-out months was of production in the pay-back months.

COMPARISON OF MARKET REQUIREMENTS FOR MILK WITH SEASONAL SUPPLY OF MILK

It was pointed out earlier that the seasonal variation in local production was usually much greater than the market requirements for milk for fluid consumption in practically all markets. In other words, the local production of milk usually exceeds market requirements for fluid use in the flush production months and may be less than market requirements in certain of the fall and winter months. In order to make a direct comparison of the monthly variation in local production and local market sales the following calculations were made for the period, October 1941 to September 1948: seasonal indices of variation in producers deliveries, Class I sales, Class II sales, Class I and II sales combined. Comparable data for earlier years were virtually impossible to obtain because of the extreme change in the market area in the period before October, 1941.

A 12 months' centered moving average was calculated on Total Daily Average Producer Deliveries by months for the period October, 1941 to September, 1948 to determine an index of the variation in deliveries of all producers to the market.

The peak month of deliveries was June and the month of smallest deliveries was December. Deliveries in December were 68.4 per cent of those in June. The range between June and December was 38.4 per cent. The three peak months of deliveries were May, June, and July which coincides with the take-out period of the Plan. The three months of smallest deliveries--November, December and January--correspond fairly closely to the pay-back months of the Plan. However, the three months of smallest deliveries lag one month later than the three months of the pay-back period--October, November and December. The seasonal index of variation in producers' deliveries to the market for the period October, 1941 to September, 1948 is shown in Table 1.

The seasonal indexes of sales of Class I, Class II, and Class I and II milk combined were also computed. These data are also shown in Table 1.

Table 1. Seasonal indexes of Class I, Class II, Class I and II milk sales, and producer deliveries in the Greater Kansas City milk market October, 1941 to September, 1948.

Months	Indexes of			
	Class I milk sales	Class II milk sales	Class I & II milk sales	Producer deliveries
January	101.49	97.27	100.51	85.8
February	102.60	102.50	102.52	90.2
March	103.30	103.77	103.31	93.6
April	101.62	103.40	101.99	106.8
May	99.50	105.70	100.82	116.0
June	99.43	98.81	99.41	122.4
July	96.45	91.84	95.42	116.6
August	97.69	93.25	96.73	114.9
September	100.01	96.70	99.34	98.6
October	100.25	98.06	100.16	88.2
November	99.16	101.90	99.80	83.8
December	98.48	106.01	100.01	83.1

Figures 3, 4, 5, and 6 may be used to facilitate comparison between sales and deliveries to the market. A comparison shows that there is much greater variation in producer deliveries than in market sales. The total variation in sales was less than 7 per cent of average, while the range of variation in producer deliveries was 39 per cent.

An index of irregularity was computed for each of the items shown in Table 1. The indexes are shown in Table 2.

Table 2. Indexes of irregularity of Class I, Class II, Class I and II milk sales and producer deliveries in the Greater Kansas City milk market, October, 1941 to September, 1948.

Months	Indexes of irregularity of			
	Class I milk sales	Class II milk sales	Class I & II milk sales	Producer deliveries
January	0.99	5.76	1.10	2.8
February	1.13	3.01	1.34	3.1
March	0.36	2.49	0.68	2.1
April	2.70	2.90	2.33	3.1
May	1.79	3.36	1.48	10.3
June	2.61	2.98	2.31	3.0
July	1.91	5.38	2.37	3.1
August	2.28	5.61	2.12	9.4
September	1.98	5.22	1.71	3.7
October	1.19	7.48	1.75	2.1
November	1.26	5.51	0.94	1.4
December	1.38	8.83	1.68	2.3

The index of irregularity shows the variation of the actual data around the average or trend line. It will be noted that producers' deliveries show the greatest variation in the months of May and August. One possible explanation might be that pasture conditions in May and August are highly variable. Class I milk sales showed small and relatively constant variation throughout the year. Somewhat greater variation may be seen in Class II milk sales than in Class I milk sales. Class I & II milk sales combined is weighted heavily by Class I sales, so it is quite similar to Class I sales in its variation. The amplitude ratios[1] for the data shown in Table 1 are shown in Table 3.

[1] Amplitude ratio = $\frac{dS}{S^2}$, where d is the deviation of the values of the ratio-to-trend from 100, and S is the deviation of the individual values in the index of average variation from 100.

Table 3. Amplitude ratios of Class I, Class II, and Class I & II milk sales and producer deliveries in the Greater Kansas City milk market from 1943 to 1947.

Years	Amplitude ratios of			
	Class I milk sales	Class II milk sales	Class I & II milk sales	Producer deliveries
1943	1.03	-0.20	0.62	0.79
1944	0.38	0.80	0.27	1.18
1945	0.65	1.22	0.74	1.12
1946	1.25	2.26	1.74	1.01
1947	1.31	1.52	1.44	0.99

An amplitude ratio is designed to show how well a particular year fits the average of all the years during the period under consideration with respect to the variable under consideration, seasonal variation in this case.

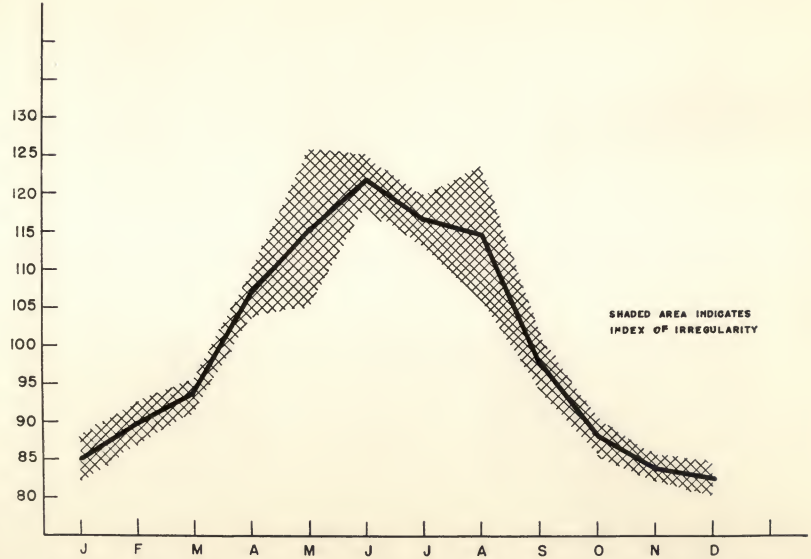
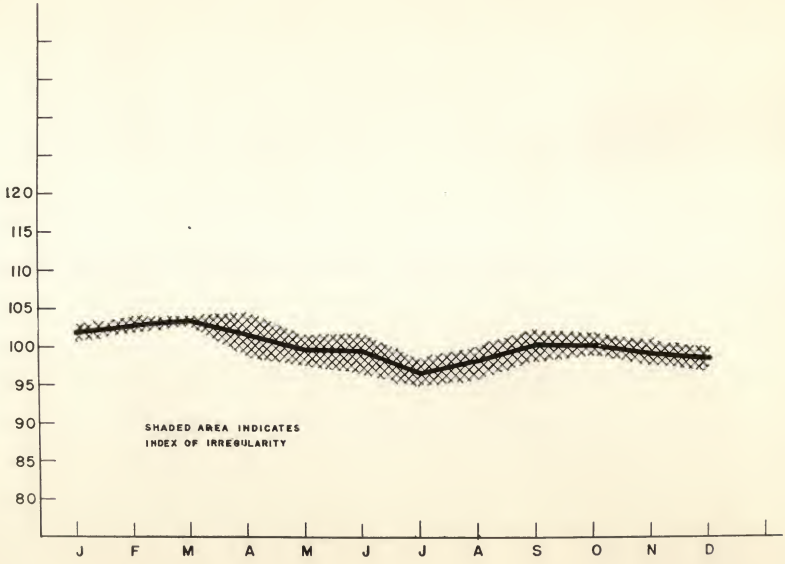


Fig. 3. Seasonal variation of total daily average producer deliveries of milk to the Greater Kansas City milk market for the period October, 1941 to September, 1948.


120
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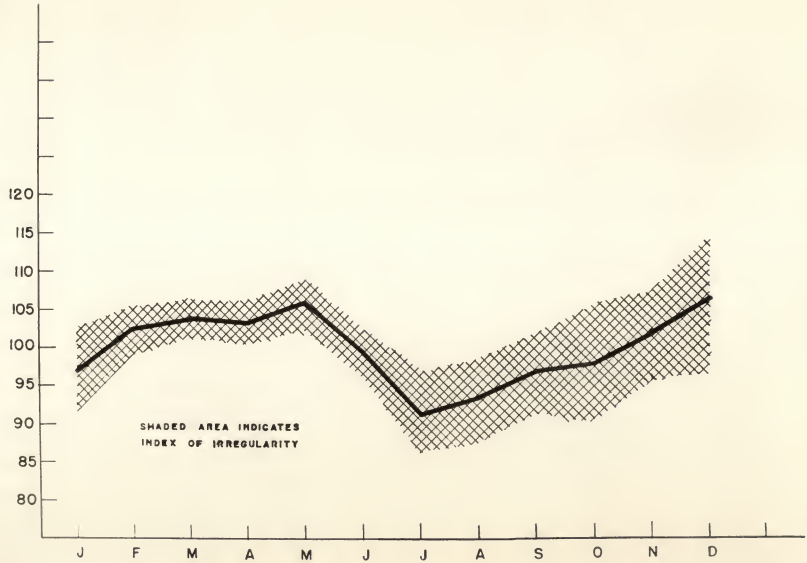

Fig. 5. Seasonal variation of total daily average Class II sales of milk in the Greater Kansas City milk market for the period October, 1941 to September, 1948.

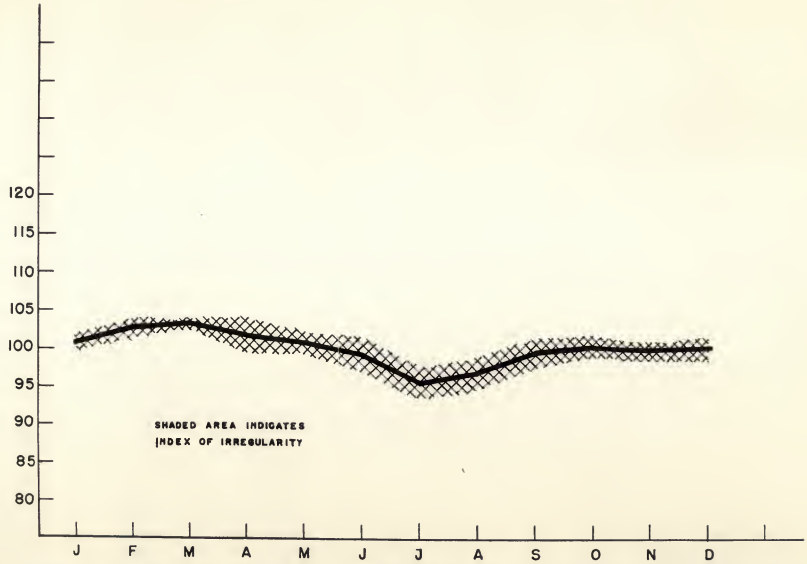

Fig. 6. Seasonal variation of combined total daily average Class I & II sales of milk in the Greater Kansas City milk market for the period October, 1941 to September, 1948.

SEASONAL PRICING PROBLEMS

The problem of seasonal milk production is extremely complicated and similar solutions to the problem may not apply to all markets. Attempts to level out seasonal milk production for a market require the close cooperation of the various groups concerned with producing, assembling, processing, and distributing milk.

In order for these groups to solve their problems they must have basic information about the organization of the local market.

Some of the questions that face the different groups concerned with seasonal pricing problems are:

1. What effect does changing seasonal variation in price have on the total quantity of milk delivered and on the unit cost of producing this milk?

2. How will a change in the seasonal differential affect the size of the market area?

3. Educational agencies have often been asked the question, "Should we encourage more specialization in dairying and also should producers be encouraged to increase the size of their producing unit in order to level out seasonal milk production?"

In order to answer the above questions and solve the problems involved, it is desirable to make certain simplifying assumptions.

The geographic area of a market depends on many and varied factors but for purposes of illustration one could assume a rather simple isolated market located in a rather homogeneous area.

In such a market it shall be assumed that the large dairy herds are located close to the market center and that the herds become progressively smaller as one moves from the market center to the periphery of the market area. Normally one could expect to find few dairy herds immediately adjacent to the market center due to the competition of urban factors for the land.

It would seem logical to assume that the farms with the larger dairy herds would be more specialized in dairying than farms with smaller herds. The farms with small dairy herds located farthest from the market would be in an area where alternative enterprises to dairying are more numerous.

It would also seem logical that as the size of herd increased and the relative importance of dairying in the farm business increased that the management of the then larger herds would take on the characteristic practices of large sized herds and there would be more emphasis put on a fall pattern of milk production. Therefore, it follows that the large farms nearer the market would emphasize a fall pattern of milk production while the farms with small herds would tend to emphasize a pattern of spring milk production.

If the preceding assumptions are granted or found to be fact one can then tell somewhat the effect pricing plans designed to level seasonal milk production will have on milk production costs and the market structure, and the volume of milk production in the market area.

Such a pricing plan will tend to stimulate the production of milk by the large herds closer to the market and tend to discourage production in the small herds on the periphery of the market. It is apparent that both total volume of milk production and the market area may be affected. The extent to which these two factors are affected will result in changes in cost of production, assembly and processing of milk. The change in the total volume of milk produced depends upon the net change in production when the larger herds increase production and the smaller herds decrease production as a result of the pricing plan.

An important factor determining the social and economic gain from such a change is whether or not the increase of production by the large herds is done at a lower cost than the production formerly contributed by the small herds.

One would need to know whether the total volume of milk was increased or decreased and at what cost in order to appraise the restrictive nature (if any) of the plan.

If no net change occurred in production or costs and the market area was reduced, significant savings might result from

transportation economies in the sense that the same volume of milk would be moved to market over a shorter distance than it was moved formerly. An attempt will be made to answer some of these questions in the following paragraphs.

An attempt has been made in this section to present some hypotheses on seasonal pricing problems, to state some of the assumptions of the study, and to raise some pertinent questions which are discussed at greater length in the following paragraphs.

MEASURES OF SIZE OF PRODUCING UNIT

A dairy farm may be classified as to size by many different factors. However, total annual production was considered the best measure of size since it includes both variations in number of cows and in milk production per cow. Two tests[1] were made using different measures of size in relation to total annual milk production and are as follows:

Measure of Size of Producing Unit

1.	Total annual milk production VS No. of wet and dry cows, Aug. 1, 1948	r = .8323
2.	Total annual milk production VS No. of wet cows, Aug. 1, 1948	r = .8180

In many areas it may not be possible to secure monthly

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[1] Figures 7 and 8.

production data to classify units by size. The above correlations, while for only one year's data, suggest that herd size as measured by either of the ways illustrated is a relatively good measure of the size of producing unit. It should be noted that the data on total annual milk production are obtained from milk deliveries to plants. There may be some variation in these data from actual farm milk production due to diversion to different outlets and home use, but there was no way to check this problem.

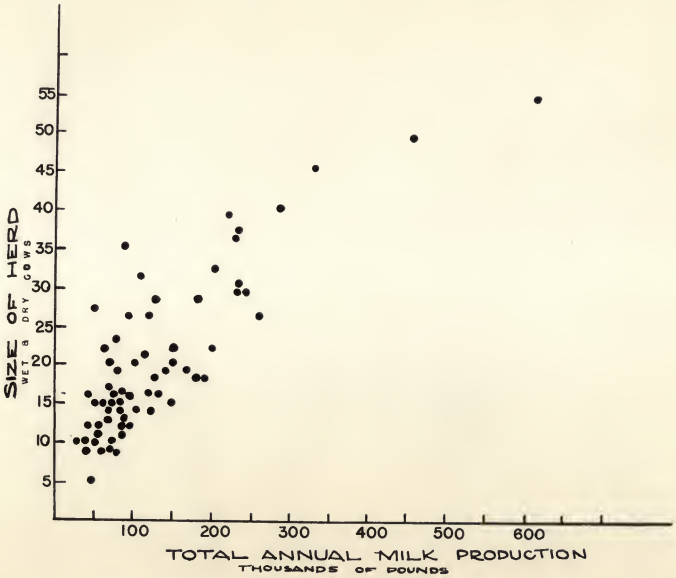

Fig. 7. The relationship between the number of wet and dry cows (August 1948) and total annual milk production for 69 farms in the Greater Kansas City milkshed for 1948.

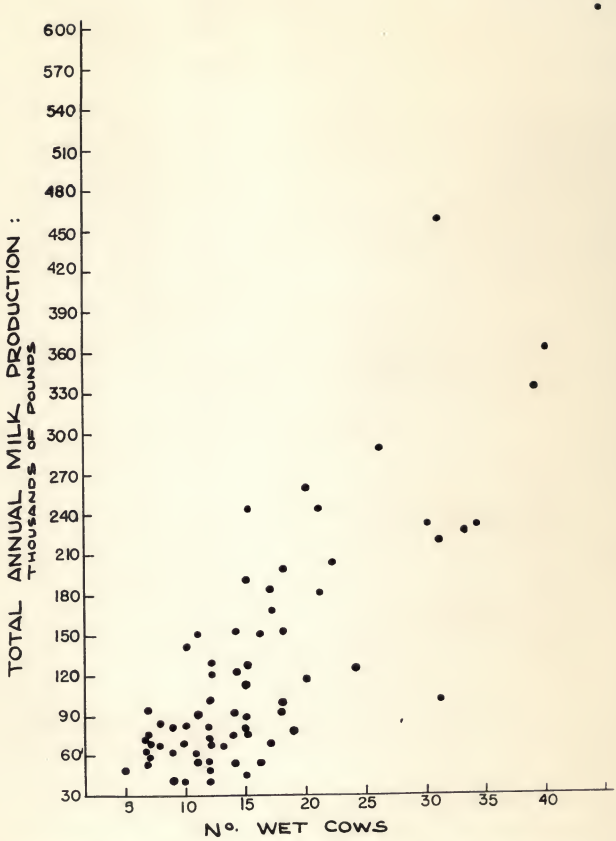

Fig. 8. The relationship between the number of wet cows (in milk, August 1948) and total annual milk production for 69 farms in the Greater Kansas City milkshed for 1948.

FACTORS AFFECTING SIZE OF PRODUCING UNIT

Distance from Market

It will be pointed out in the ensuing discussion that as producing units increase in size their production patterns become less seasonal. It is important to know where these various size producing units are located within the milkshed in order to appraise the effect of seasonal pricing plans on the structure of the market area. If the uneven producers are located on the periphery of the milkshed, seasonal pricing plans may discourage their sale to the central market and thus reduce the total milkshed area.

A correlation of total annual milk production and distance from market resulted in r = -.3292 (Fig. 9). This is a significant correlation at a 1 per cent level of probability, but not useful for prediction purposes. A correlation was not computed between herd size and distance from market. However, the average herd size for various distances from market was as follows:

Distance from Market (miles)	Average herd Size
1 to 5.9	25.29
6 to 10.9	17.16
11 to 15.9	14.9
16 to 20.9	17.46
21 to 25.9	16.33
26 to 30.0	15.75

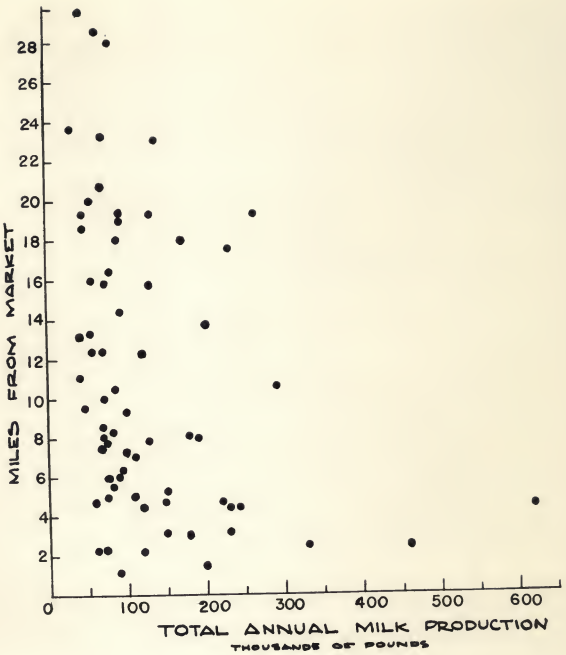

Fig. 9. The relationship between total annual milk production and the distance of the farm from market for 69 farms in the Greater Kansas City milkshed for 1948.

While all of the relationships noted above probably are not statistically significant, there is some suggestion of trend. The large herds (over 30 cows) tend to be concentrated in the areas within 11 miles of the Kansas City market.

Diversity of Enterprises

It was assumed that as the diversity index[1] became smaller, indicating increased specialization, that total annual milk production would increase since the farms under consideration were predominantly dairy farms. The correlation between these two factors was r = -.3015 (Fig. 10), indicating significance at a 1 per cent level of probability, which lends some credence to the assumption that was made.

Relative Importance of Dairying in the Farm Business

It was assumed that as dairying becomes more important in the farm business that the size of the producing unit would increase. In order to test this assumption a correlation was computed between importance of dairying, as a per cent of potential farm income, and total annual milk production. An r of +.4347 (Fig. 11) was obtained. This was highly significant at a 1 per cent level of probability. This indicated that the foregoing assumption was correct and that there is a definite relationship between importance of dairying in the

[1] Method of computation may be found in Appendix.

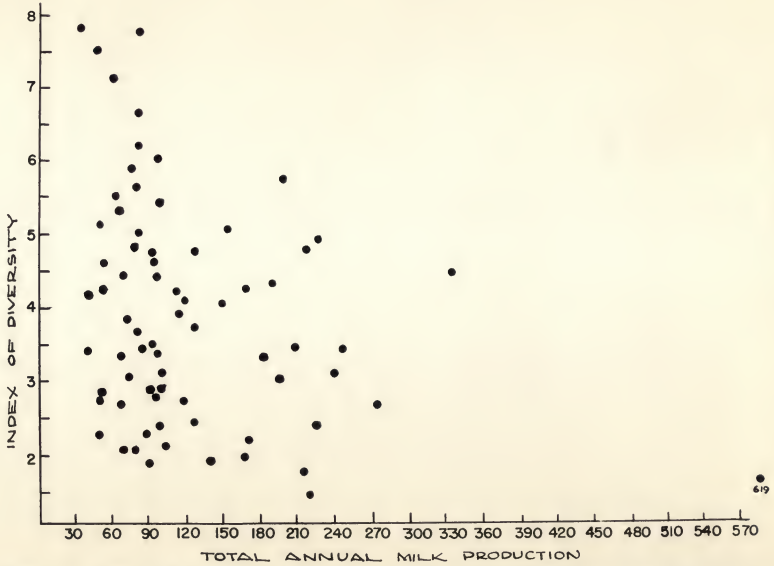

Fig. 10. The relationship between the index of diversity and total annual milk production for 74 farms in the Greater Kansas City milkshed for 1947.

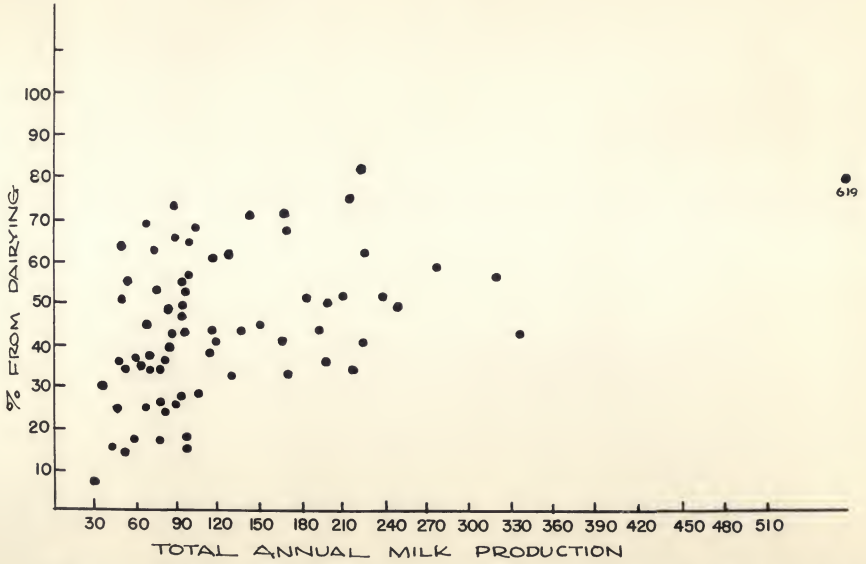

Fig. 11. The relationship between the relative importance of dairying in the farm business and total annual milk production for 74 farms in the Greater Kansas City milkshed for 1947.

farm business and size of producing unit.

FACTORS AFFECTING SEASONALITY OF MILK PRODUCTION

Size of Producing Unit

The question is often asked whether there is any difference in the seasonal pattern of production as the volume of annual milk production increases. It seems to be a logical assumption that as the size of the milk producing unit increases the seasonal pattern of production might conform more closely with the seasonal pattern of market needs because presumably more attention could be given to dairying on the larger sized units. In other words, one would expect the larger producers to produce a greater proportion of fall milk relative to spring milk than the smaller producers.

In order to check this assumption, complete records of 69 farms were studied for the year 1948. It previously was determined that the size of the producing unit could be more accurately measured by using total annual milk production as a measure of size rather than the number of cows in the herd. The next problem was to find a more satisfactory measure of the seasonality of milk production. Accordingly two different analyses were made. The first method was a study of the relationship between total annual milk production and seasonality of milk production using 12 months' production data. The

second method was an analysis of the relationship between total annual milk production and seasonality of milk production using the take-out and pay-back months as a measure of seasonality.

The analysis using the first method was as follows: for each farm each month's milk production was expressed as a percentage of the 1948 annual milk production of that farm. These percentages were arrayed in a frequency table by months. It was noted that the array of percentages for each month has about the same range and that the central tendency of the arrays of percentages for each month could be represented quite well by an arithmetic average. The 12 monthly averages represent a seasonal index of the 69 patterns of production with the effect of volume of production removed.

In order to determine if the patterns of production tended to change as the volume of total annual milk production increased, the 69 records of percentage production by months were arrayed according to total annual milk production. This size order array of 69 farms was divided into three groups of 23 farms each representing the small one-third, middle one-third and large one-third of the farms. The ranges in production represented by these three groups were as follows:

Small group	30,384 to 72,576 lbs. of milk per year
Middle group	73,209 to 127,692 lbs. of milk per year
Large group	130,847 to 620,770 lbs. of milk per year

Frequency tables were then computed for each of the above three size groups. The seasonal pattern of each size group

was computed by calculating the arithmetic average of the per cents for each month. These averages constitute an index of the seasonal patterns for each size group and are given in Table 4.

Table 4. Seasonal patterns of production of 69 farms and three size groupings of these 69 farms in the Greater Kansas City milkshed for 1948.

	Small 1/3	Middle 1/3	Large 1/3	Total
January	6.11	7.08	7.75	6.98
February	6.63	6.63	7.32	6.86
March	7.81	7.53	7.86	7.73
April	8.95	8.69	9.08	8.91
May	10.89	9.97	10.35	10.40
June	10.04	9.02	8.72	9.26
July	10.21	9.51	8.62	9.45
August	9.74	9.73	8.54	9.34
September	8.28	8.66	7.90	8.28
October	7.24	8.11	8.08	7.81
November	6.73	7.30	7.62	7.22
December	7.37	7.77	8.16	7.76

An analysis of variance showed that the seasonal patterns for the three size groups were significantly different at the 1 per cent level of probability. The seasonal pattern of the small one-third of the farms as measured by total annual milk production had a wider range from high to low than the seasonal pattern of the large one-third of the farms.

Curves corresponding to the seasonal pattern of each group and the average for the groups as a whole were plotted to facilitate comparisons (Fig. 12).

All three groups had their peak per cent of deliveries during the month of May. During May, the low groups delivered about 11 per cent of their total annual deliveries on a percentage basis, and medium group about 10 per cent and the large group about 10.5 per cent. The low and medium groups remained fairly high during the remainder of the summer (June, July and August) and did not drop off sharply until September. The large group, however, after peaking in May, fell off sharply during June and then more gradually into the winter months.

In other words, the small and medium groups had a seasonal peak that was higher and extended over a longer period than the large group.

The large group was above the average for the three groups in October, November, December, February and March, whereas the small and medium groups were below or about equal to the average for that same period. (Exception was the medium group in October.) In other words, the large group offsets the more extreme seasonal effect of the low and medium groups.

In order to appraise the importance of variation in seasonal patterns of production more completely, consideration must be given to the total volume of milk produced by the different size groups. The total annual milk productions for 1948 are shown in Table 5.

Table 5. Total annual milk production by size group for 69 farms in the Greater Kansas City milk market for 1948.[1]

Size	Range in production per farm, pounds of milk	Total pounds of milk
Small 23 farms	30,384 to 72,576	1,341,609
Middle 23 farms	73,209 to 127,692	2,215,223
Large 23 farms	130,847 to 620,770	5,299,415

[1] It should be noted that these data represent only one year and different relationships might exist in other years.

It has been pointed out that the larger size groups definitely have a more desirable seasonal pattern of production. This is significant from the standpoint of the market because the largest group studied delivered approximately four times as much milk as the smallest group and one and one-half times as much as the small and medium groups combined. It would therefore seem desirable to encourage the smaller producers to adopt the desirable production and marketing practices of the larger producers and to increase their size of producing unit where possible.

The second method of comparing the size of producing unit to seasonality of milk production consisted of a correlation analysis between total annual milk production for the 69 farms and their seasonal indexes as computed from the take-out and pay-back months. An r of -.2350 (Fig. 13) was obtained. This is significant at the 5 per cent level of probability.

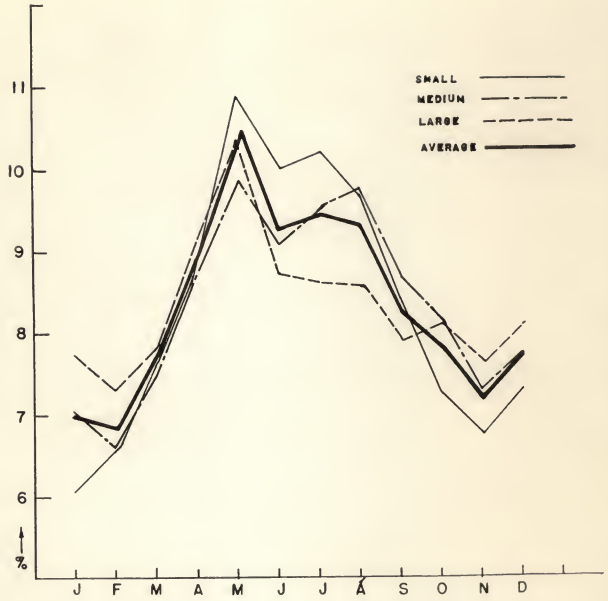

Fig. 12. Summary of average seasonal production patterns for the 23 large, 23 medium and 23 small farms and the average for 69 farms in the Greater Kansas City milkshed for 1948.

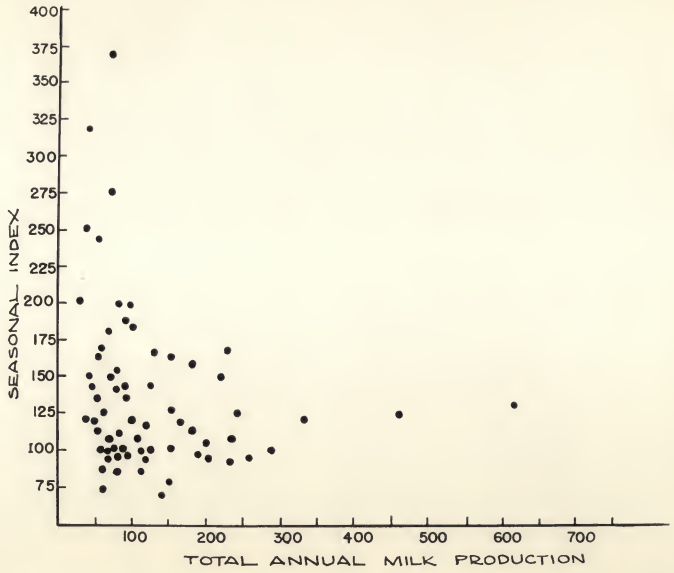

Fig. 13. The relationship between total annual milk production and the seasonality of milk production for 69 farms in the Greater Kansas City milkshed for 1948.

The results of the second method suggest that measuring seasonality of individual farms by using the take-out and pay-back months is not too satisfactory when compared with the results obtained from a study of the production patterns of individual farms.

Diversity of Enterprises

In the preceding discussions, it was pointed out that there was a tendency for herds to become smaller as they were located farther from the market. It was also pointed out that herds tended to have wider seasonal patterns as the size of the producing unit decreased.

One explanation of this situation might be that the competition in the use of resources from other crop and livestock enterprises encourages the farmer to devote less time and effort to the dairy enterprise.

In order to check this assumption, a diversity index was computed to determine the diversity in enterprises on individual farms. As the number of significant enterprises increases the index of diversity increases.[1]

A correlation between the indices of diversity and seasonal production gave r = +.0186 (Fig. 14), which is nonsignificant at a 5 per cent level of probability.

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[1] See Appendix for computation of Index of Diversity.

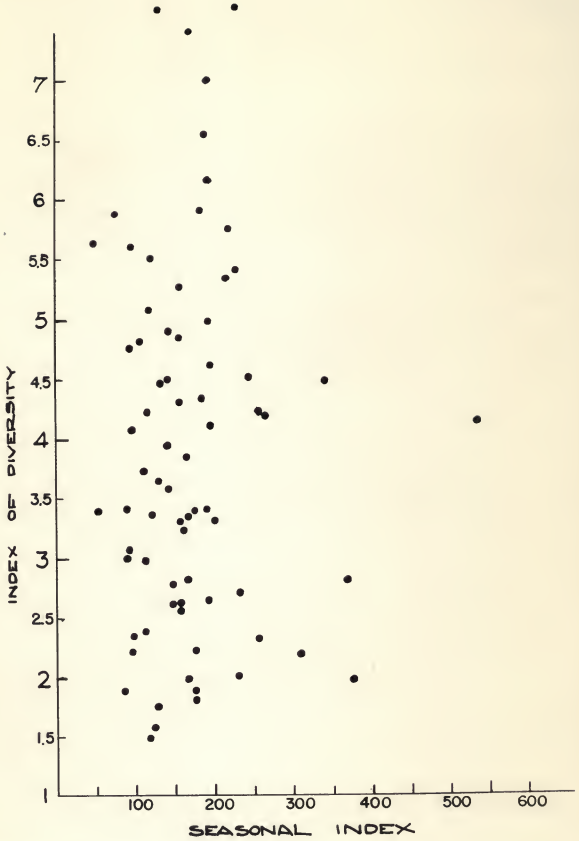

Fig. 14. The relationship between the index of diversity and the seasonality of milk production for 74 farms in the Greater Kansas City milkshed for 1947.

Relative Importance of Dairying in the Farm Business

It was assumed that as dairying became more important in the farm business, producers would tend toward more even milk production and thus reduce the seasonality of milk production. In order to verify this assumption a correlation between the two factors was computed. The resultant r was -.0955 (Fig. 15), which is nonsignificant at a 5 per cent level of probability.

The above correlation and the correlation between diversity of enterprises and seasonality suggest that stressing more specialization in dairying to encourage more even milk production may not be entirely justified.

Distance from Market

As might be suspected from the preceding discussion of factors affecting seasonality the distance a producer is from market may have some effect on his seasonal index. It has been shown that as distance from market increases the size of herd decreases and size of producing unit as measured by annual milk production declines also. And it has further been shown that as size of unit declines there is a tendency toward more uneven milk production. It therefore follows that as the distance from the market center is increased the seasonality of milk production will increase. To substantiate this contention a

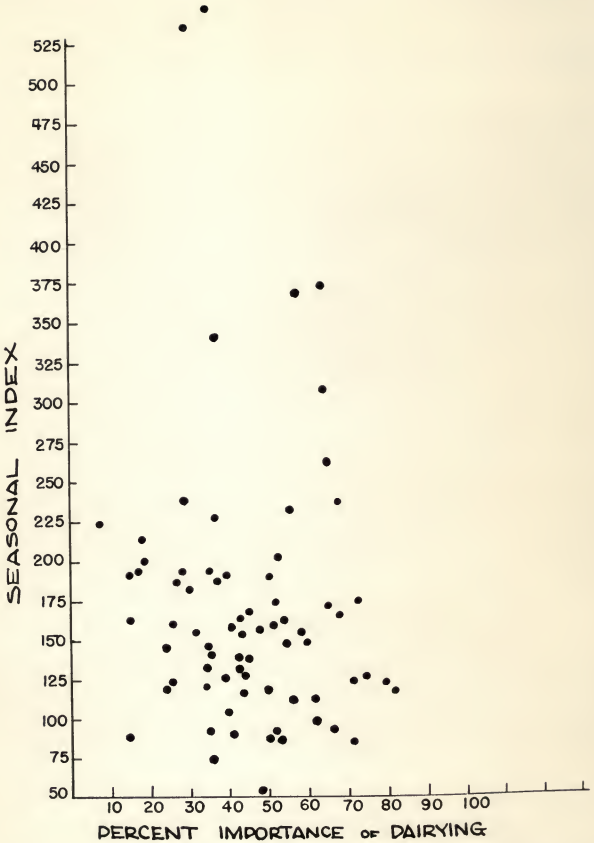

Fig. 15. The relationship between the relative importance of dairying in the farm business and the seasonality of milk production for 74 farms in the Greater Kansas City milkshed for 1947.

correlation was computed between distance from market and seasonality of milk production. The resultant r = .4811 (Fig. 16), is highly significant at a 1 per cent level of probability.

STABILITY OF MILK PRODUCTION ON FARMS

Another problem of extreme importance in trying to level out seasonal milk production is the stability of the individual producing units. A high rate of turnover in the number of producers and wide fluctuations in farm production from year to year are undesirable.

In order to determine what particular groups of farms were of either increasing, decreasing, or relatively constant production, 62 farms were studied on which 12 month production records for 1946, 1947, and 1948 were available.

Decreases in total annual production from 1946 through 1948 were shown by 13 farms while increases in total annual production occurred on 6 farms for the same period. The significant difference between the two groups was that the farms having decreases in production were farms with smaller production than those with increases in production as shown in Table 6.

The average annual production in 1948 for the smaller farms which showed decreases was 86,600 pounds while the average annual production for the larger farms in 1948 which showed

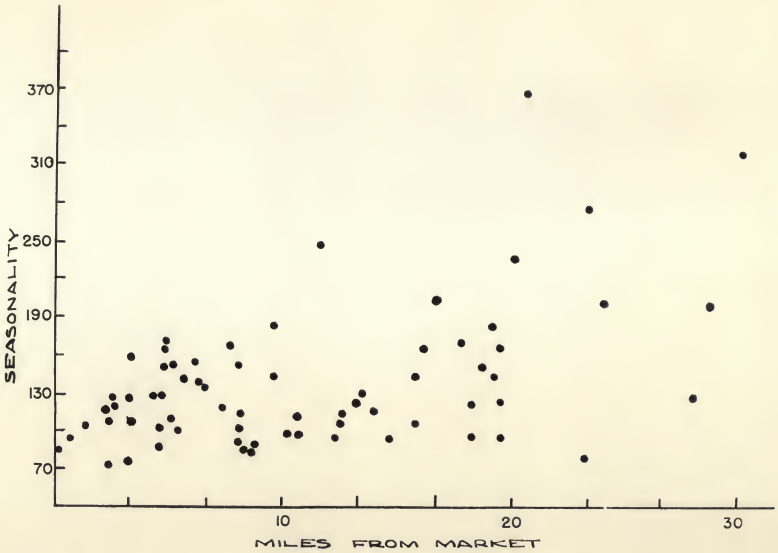

Fig. 16. The relationship between the distance farms were from market and the seasonality of milk production for 69 farms in the Greater Kansas City milkshed for 1948.

increases for the period was 221,800 pounds.

The remaining 43 farms showed varying patterns of production, some increasing in 1947 and decreasing in 1948 and vice versa.

Table 6. Increases and decreases in total annual milk production for 19 farms in the Greater Kansas City milkshed for 1948.

	Farms on which production increased 1946-48	Farms on which production decreased 1946-48
	thousands of pounds	
	121.8	30.4
	130.8	40.5
	152.6	46.0
	229.4	48.7
	233.8	53.7
	462.4	64.3
		70.8
		72.1
		79.6
		90.5
		143.8
		183.7
		202.0
Average	221.8	86.6

In order to determine if similar relationships existed from year to year, the percentage increase of the 1947 production over the 1946 production was calculated. The farms were then classified into two groups according to whether they increased or decreased production in 1947. The data showing increases in production were arrayed from the smallest percentage increase to the largest percentage increase. The same

array was made of the data showing decreases in production from 1946 to 1947.

The variation in the percentage increase of 1947 production over 1946, as shown in Table 11[1], ranged from +0.5 per cent to +53.2 per cent. The variation in the percentage decrease of 1947 production over 1946 production ranged from -1.0 per cent to -64.9 per cent. If a +10.0 per cent variation in production is arbitrarily assigned as a measure of rather stable production, it will be noted that those farms which increased production more than 10 per cent averaged larger in total annual milk production than those who decreased production more than 10 per cent (Table 13)[1]. This would indicate that the large producers are becoming larger and the small producers smaller.

The same calculations were made comparing 1948 productions with 1947 productions. The same trend as observed in 1947 occurred in 1948. There was a definite tendency for the smaller farms to continue to decrease during the period (1946 to 1948) and for the larger farms to grow larger as measured by total annual milk production. The data for 1948 are shown in Tables 12 and 14.[1]

Several reasons may explain this trend in size. The years 1946 through 1948 were for the most part a period of rising agricultural prices. Because of this it may have been that

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[1] Appendix.

producers with small herds found alternative opportunities that were more profitable. The larger producers were principally dairy farms and could only expand their farm output primarily by increasing dairy output.

As was pointed out above, ±10 per cent or less variation was considered to be relatively stable production. Under this assumption of stability about 55 per cent of the market supply of milk could be considered stable from 1946 to 1947 and about 52 per cent from 1947 to 1948. These data are shown in Tables 13 and 14.[1]

PROFIT AND LOSS UNDER THE PLAN

Opinions vary on the effect of the take-out and pay-back plan on production response. There are two main schools of thought on the controversy. One school contends that producers adjust their production according to the increase in seasonal variation in price as a result of the plan. The other school contends that farmers discount the increased variation in seasonal price and put the main consideration on the amount of net gain or loss as a direct result of the take-out and pay-back payments.

If a producer's production pattern is more seasonal than the market average then the loss as a result of the plan must

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[1] Appendix.

be great enough to encourage him to improve his seasonal pattern. If a producer's production pattern is average or better than the market average then the total profit incentive must be great enough to encourage him to still further improve his seasonal production pattern.

Profits and losses[1] were computed for each sample producer under the plan in 1946 and in 1947. An average profit of $23.03 was made by 35 producers in 1946 while in the same year an average loss of $14.14 was made by 39 producers. During 1947 the average profit for 35 producers was $30.68 and the average loss for 39 producers was $13.46.

The range of profit and loss for both years is indicated in Table 7, which also shows the frequency distribution of profits and losses for both 1946 and 1947.

It was evident by this table that most of the producers' profit was within a range of ± $20.00 in both years. This indicated that the Plan probably has little effect from the standpoint of size of payment involved and the only beneficial effect may be the psychological reaction to the Plan itself. In other words, the amount of money involved in the take-out and pay-back processes of the Plan does not seem to be sufficient to merit economic consideration.

The obvious relationship between profit and loss and

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[1] Not profits and losses for the farm as a whole but the net gain or loss from the actual operation of the take-out and pay-back Plan.

Table 7. A frequency distribution by profit or loss under the Plan for 74 producers in the Greater Kansas City milk market for 1946 and 1947.

Class interval dollars	Frequency 1946	1947
-60 to -69.99	1	0
-50 to -59.99	0	0
-40 to -49.99	0	1
-30 to -39.99	4	2
-20 to -29.99	6	8
-10 to -19.99	8	9
+ 0 to - 9.99	20	19
+ 0 to 9.99	11	9
10 to 19.99	6	5
20 to 29.99	6	4
30 to 39.99	7	7
40 to 49.99	2	0
50 to 59.99	2	6
60 to 69.99	1	2
70 to 79.99	0	2

seasonality is evidenced by Figs. 17 and 18, showing the relationships between these two factors for 1946 and 1947.

It is only natural that there should be a high correlation between seasonality and profit or loss since the profit or loss under the Plan depends directly on the seasonality of milk production. The correlation between these two factors for 1946 gave $r = -.7403$ (Fig. 17) and for 1947 $r = -.7512$ (Fig. 18). Both of these correlations are significant at a 1 per cent level of probability.

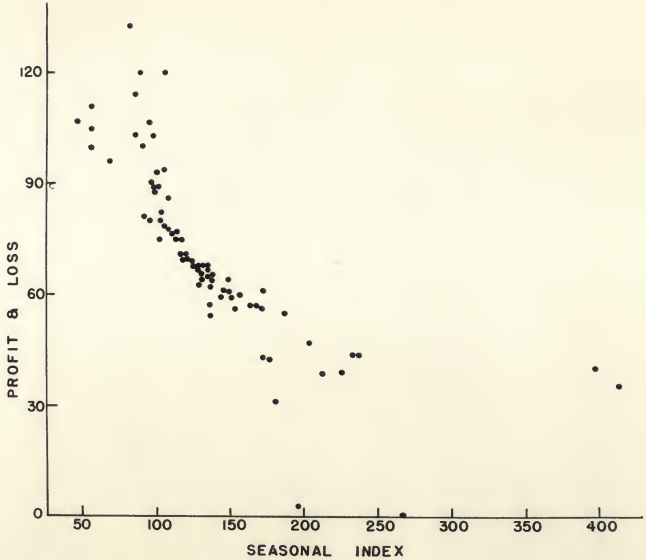

Fig. 17. The relationship between the seasonality of milk production and net return from the take-out and pay-back Plan for 74 producers in the Greater Kansas City milkshed for 1946.

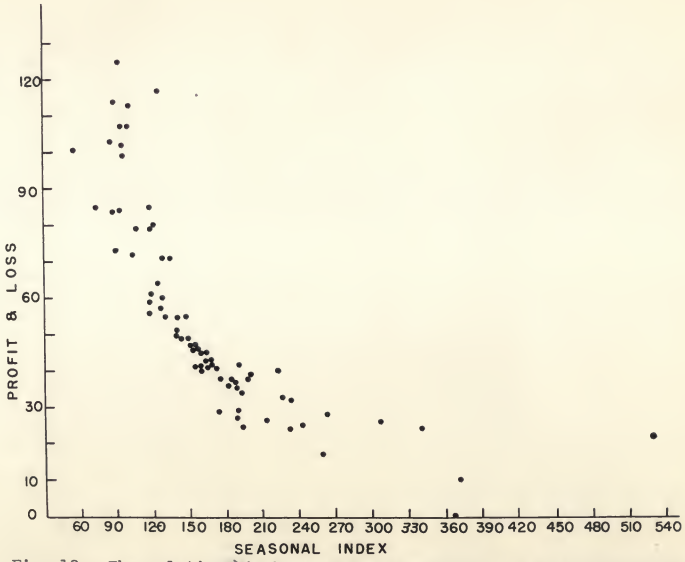

Fig. 18. The relationship between the seasonality of milk production and net return from the take-out and pay-back Plan for 74 producers in the Greater Kansas City milkshed for 1947.

TAKE-OUT AND PAY-BACK MONTHS

In order to determine how closely the take-out and pay-back months corresponded to the highs and lows of market deliveries by the sample farms an analysis was made of 62 farms in 1946 and 69 farms in 1948.

Using the percentages that monthly production was of annual production for the sample farms a series of Tables was constructed. In these Tables the extremes of seasonality were plotted with each other; i.e., the highest monthly percentage was plotted with the lowest, the second highest with the second lowest and the third highest with the third lowest after the manner shown in Table 8.

This was a convenient way of showing the frequency with which various months are found to be either high or low, second high or second low, etc.

From an observation of Tables 8 and 9, a composite of the first, second, and third highs with first, second, and third lows for 1946 and 1948, it would seem that for all practical purposes the take-out months should be extended to include August and possibly April and September. The pay-back should be extended to include January and February. However, the results cannot be conclusive since the data represented only two years, 1946 and 1948.

To check the above analysis a monthly summation of milk deliveries was made for the sample farms for 1946, 1947, and

Table 8. Summary of first, second, and third highs plotted with first, second, and third lows for 62 farms in the Greater Kansas City milkshed for 1946.

	1st, 2nd, & 3rd Highs												
	J	F	M	A	M	J	J	A	S	O	N	D	
J:			'	'''''	'''''	'''''	''''	'''	''	'			33
F:			'''''	'''''	'''''	'''''	''	'''''	'''''''	'	'	'''''''	44
M:			''	'''	'''''	'		'''''	'	'''	''	''	23
A:				'		'		'			'''		6
1st M:	'											'	2
2nd J:	'	''							'	'	'		6
& J:	''	'				''				''			7
3rd A:			''''	'				'		'	'		8
Lows:			'	''	''	'				'	''		9
O:		'	'	'''	'	''''	'				''		13
N:	'		'''''	'''''	'''	''''	'''	''					25
D:				'	'''''	''	''		'				11
Total 3	3	4	22	36	32	22	20	13	9	9	14		

Table 9. Summary of first, second, and third highs plotted with first, second, and third lows for 69 farms in the Greater Kansas City milkshed for 1948.

	1st, 2nd, & 3rd highs												
	J	F	M	A	M	J	J	A	S	O	N	D	
J:													27
F:													40
M:													19
A:													6
1st M:													0
2nd J:													7
& J:													8
3rd A:													14
Lows S:													18
O:													22
N:													26
D:													20
Total	8	6	8	18	44	18	28	28	14	12	9	14	

1948 (Fig. 19). The months of largest deliveries and of smallest deliveries correspond very closely to the months in which the greatest number of producers had their peaks and their lows, respectively.

SUMMARY AND CONCLUSIONS

The forepart of this study was a presentation of the general problem of seasonality. The major emphasis of the study was placed on two areas of investigation. The first was an attempt to analyze some of the factors responsible for seasonality of milk production. The second was concerned with the effect of seasonal pricing plans on the physical structure of the market area and on producers' costs and returns.

After limiting the discussion to seasonality as it concerns the producer, a presentation of logical factors affecting seasonality was made which included:

1. Size of producing unit
2. Location of producing unit
3. Diversity of farm organization
4. Relative importance of the dairy enterprise to the farm business

Before analyzing the effect of size of producing unit on seasonality it was necessary to determine the best measure of size. Total annual milk production per farm was the best measure of size of producing unit since it took into account both the number of cows and the production per cow throughout

Fig. 19. Total deliveries by months of 74 sample producers to the Greater Kansas City milk market for 1946, 1947 and 1948.

the year. Herd size, measured in any manner, does not take into account the latter factor.

In discussing the factors affecting size it was pointed out that the distance a producer is from the market has a significant bearing on the size of his producing unit. The farther the producer was removed from the market center the more likely was he to have a small producing unit. This was presumed to be because of, among other things, higher transportation costs and greater availability of satisfactory alternative enterprises at greater distances from the market.

The second factor presumed to be affecting size of unit was the diversity of enterprises on individual farms. It was established here that as the diversity of enterprises increases the size of unit decreases which, as was pointed out, would be the logical expectation since the farms are all dairy farms.

Another factor considered as affecting size of producing unit was the relative importance of dairying in the farm business. This factor was established as having a significant effect on size of producing unit. As the relative importance of dairying increased the size of unit also increased.

After analyzing the major factors affecting size of unit and deciding that total annual production was the best measure of size; attention was turned to the major problem, that of seasonality of milk production.

The first factor to be considered in its relationship to seasonality was size of producing unit. The problem was

attacked from two different angles. The first analysis was of 12 month production patterns showing seasonal variation in production by months. The second analysis was from the standpoint of seasonality as measured by the take-out and pay-back months of the Plan. The first method established a significant relationship between size and seasonality by showing that seasonal patterns of production decreased as total annual production increased. The second method, however, did not show the same results. The relationship between size and seasonality by this method was barely significant. It was pointed out that this was probably due to the fact that the take-out and pay-back months of the Plan are not an accurate measure of seasonality.

The second factor presumed to affect seasonality was diversity of enterprises. This factor, of itself, however, seemed to have no material effect on seasonality. It may affect seasonality through its influence on size of producing unit.

The third factor considered was the relative importance of dairying. This factor also had little relationship to seasonality of milk production.

An observation of factors two and three suggested that there might be little advantage in advocating specialization in dairying to alleviate seasonality of milk production.

The fourth factor thought to affect seasonality was the distance producers were from market. This was found to be a

significant relationship. Seasonality of production increased as distance from market increased.

The next problem considered was that of stability of production. The study indicated that the trend is for large producers to become larger and small producers to become smaller. The study further indicated that 50 per cent of the milk produced on sample farms was produced on those whose year to year production was relatively stable.

Another aspect analyzed in the study was the relation of profits and losses to seasonality. The obvious relationship exists since the difference between the take-out and pay-back depends directly on seasonality of milk production. The amount of money involved in the plan is insufficient for economic consideration.

The last analysis was an attempt to determine whether the present take-out and pay-back months were the most effective months to use. The evidence presented by the study shows that the months of the take-out and pay-back are probably not the best that could have been chosen for the particular farms studied. The data indicated that the take-out and pay-back should be extended over a longer period. It was suggested that April and August should be included in the take-out period and that the late winter months January and February should be included in the pay-back period.

RECOMMENDATIONS

In conclusion, there are two major recommendations to be made. The first concerns the plan itself. It is recommended that some consideration be given to increasing the incentive payment under the Plan. This could be accomplished by three different ways or any combination of the three. The first way would be to increase the rate of take-out, and therefore the pay-back, keeping the months of take-out and pay-back as they are at present. The second way would involve increasing the take-out months relative to the pay-back months. The third way to increase the incentive payment would be by variation in the rate of take-out between months.

The second recommendation is that a study be conducted to determine the relative costs of producing milk at different seasons of the year for different sized producing units. One purpose of this is to help determine the size of the incentive needed to change milk production patterns. A further purpose would be to ascertain the production and marketing practices of the larger producers to determine why they have relatively favorable seasonal production patterns.

ACKNOWLEDGMENT

Acknowledgment is made to Professor P. L. Kelley for very valuable assistance and guidance throughout the entire preparation of this thesis; to members of the Kansas City Pure Milk Producers Association; to the office of the Kansas City Federal Milk Market Administrator; and to all members of the Department of Economics and Sociology whose reading and helpful suggestions for improvement of the thesis were thankfully considered.

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APPENDIX

Index of Diversity

The index of diversity is found "by squaring the fraction that receipts from each enterprise represent of total receipts and by dividing the sum of these squares into one."[1] Unity as a result of this computation indicates complete specialization, or conversely, complete lack of diversification.

It was not possible to obtain the receipts from various farm enterprises in the study so as a substitute for this an alternative procedure was devised. This consisted of using physical production data which were available and multiplying it by an average price[2] for each commodity in question.

This "potential income" figure was used in Forster's formula in the place of receipts. An example of how the index for individual farms was computed follows:

Enterprise	Production X Price[2]	Fraction of total	Fraction squared
Corn	$1,000.00	.055	.003025
Oats	300.00	.016	.000256
Silage	1,500.00	.082	.006724
Pasture	2,500.00	.137	.018769
Milk	9,000.00	.492	.242064
Pork	4,000.00	.218	.047524
Total	18,300.00	1.000	.318362

Diversity index = $\frac{1}{.318362} = 3.14.$

1 Farm Organization and Management, p. 180.
2 3-year average yearly farm price (1945-46-47).
Source: "Crops and Markets".

This index does not give diversity of enterprises from the standpoint of actual income but is a rough measure of potential income. There was some overlapping which could not be dispersed, except arbitrarily, so it remains. As, for instance, the income for pasture and silage appears again partially in milk sales.

Frequency Distribution by Size of Herd

A frequency distribution (Table 10) by size of herd of the 74 farms in the study shows the modal herd size to be 16 cows and the median falls between 16 and 17 cows per herd. The average size of herd as defined by the arithmetic mean is 20 cows.

Table 10. Summary table of frequency distribution by size of herd of 74 farms producing milk at least two years (1946-47) in the Kansas City milkshed.

Herd size	Frequency
1 - 5.9	1
6 - 10.9	9
11 - 15.9	20
16 - 20.9	19
21 - 25.9	7
26 - 30.9	8
31 - 35.9	3
36 - 40.9	4
41 - 45.9	1
46 - 50.9	1
51 - 55.0	1

Table 10 indicates clearly that the central tendency in size of farm is from 11 to 20 cows per herd.

A breakdown by type of tenancy, whether owner, part-owner or renter did not reveal a great deal of difference between the groups. Had the sample been larger, more definite relationships might have become apparent. The central tendency of all three sub-groups occurred at the same place as for the group as a whole.

Federal Milk Orders

The Greater Kansas City Area operates under Federal Milk Order No. 13. Some of the provisions of Order No. 13 are as follows:

Marketing Area:

Missouri -- Jackson County and parts of Clay and Platte Counties.

Kansas -- Wyandotte County and parts of Johnson and Leavenworth Counties.

Milk Classification:

Class I -- Fluid milk (over 1 per cent butterfat) and unaccounted for milk.

Class II -- Cream, flavored milk, creamed cottage cheese, creamed butterfat, cream products in fluid form (less than 18 per cent butterfat), aerated cream, and eggnog.

Class III -- Butter, cheese (other than creamed cottage cheese), evaporated milk, condensed milk, ice cream, and powdered whole milk, milk used for started churning, wholesale baking, and candy making; milk accounted for as salvage from products where the recovery of butterfat is not possible; and shrinkage not over 3 per cent of butterfat received (excluding butterfat received from other handlers).

Class Prices (3.8 per cent butterfat):

Basic Formula Prices

A basic formula price is used for both Class I and Class II prices. The basic formula price is the higher of:

(1) Average of price for 3.5 per cent milk at 18 specified plants, divided by 3.5, times 3.8 (see plant list for Class III price in Chicago order).

(2) Price per pound of Chicago 92-score butter, times 3.8 times 1.2, plus or minus 3.5 cents for each half cent variation from 5.5 cents in the carlot price per pound of dry skim milk (human consumption, f.o.b. plants in Chicago area).

Class Price Differentials:

Class I -- For the months of March through August, the basic formula price plus $1.00; for the other months of the year, the basic price plus $1.45.

Class II -- For the months of March through August, the basic formula price plus 75 cents; for the other months of the year, the basic price plus $1.20.

Class III -- Highest price quoted for ungraded milk of 3.8 per cent butterfat at any of the following plants:

Meyer Sanitary Milk Co.,	Valley Falls, Kansas
Franklin Ice Cream Co.,	Tonganoxie, Kansas
Milk Producers' Marketing Co.,	Kansas City, Kansas

Description of Area

The area of the milkshed from which the Kansas City market draws its supply of milk is comprised of 20 Missouri counties and 12 Kansas counties.

20 Missouri Counties		12 Kansas Counties	
Lafayette	Buchanan	Douglas	Atchison
Jackson	Andrew	Leavenworth	Jefferson
Johnson	Ray	Johnson	Franklin
Bates	Grundy	Miami	Shawnee
Cass	Davies	Linn	Jackson
Caldwell	Henry	Wyandotte	Doniphan
Clay	St. Clair		
Clinton	Carroll		
DeKalb	Pettis		
Platte	Saline		

The greatest proportion of the market supply of milk is drawn from the counties closest to Kansas City with only a few producers in the outlying counties.

The area is typified by general farming, livestock, dairy and cash grain farming. Corn is the predominant grain crop followed in importance by oats and wheat. Alfalfa, lespedeza, and timothy are the major hay crops.

Table 11. Per cent change in annual milk production from 1946 to 1947 for 62 farms in the Greater Kansas City milkshed.

Farms reporting			
Increases in production		Decreases in production	
% increase	1947 annual production	% decrease	1947 annual production
.5	96.9	1.0	225.4
2.7	143.8	1.2	82.8
3.1	69.5	1.6	103.8
4.9	72.2	1.9	277.1
5.1	129.3	2.7	245.9
6.0	73.0	2.9	240.4
6.9	82.2	3.6	172.3
7.3	172.9	4.2	211.9
8.2	95.9	5.2	77.3
8.5	53.6	5.4	70.7
8.7	78.1	7.1	198.0
8.8	76.2	7.5	95.4
9.1	118.1	8.8	216.5
11.7	84.9	8.8	226.9
12.4	118.9	9.5	619.4
14.6	338.7	9.8	96.2
15.9	101.5	9.8	75.5
17.6	94.8	13.8	90.0
18.7	128.0	14.1	118.2
20.1	183.1	14.2	70.7
23.4	319.8	14.3	53.3
32.2	197.1	14.4	92.7
38.1	167.9	15.2	49.1
40.0	108.5	15.7	47.2
44.5	194.3	15.8	85.2
45.7	223.7	16.7	86.1
53.2	96.8	17.1	41.7
		17.6	113.0
		22.4	35.6
		22.5	54.9
		23.8	60.6
		24.4	87.2
		25.5	52.6
		36.8	105.0
		64.9	66.5

Table 12. Per cent change in annual production from 1947 to 1948 for 62 farms in the Greater Kansas City milkshed.

Farms reporting			
Increases in production		Decreases in production	
% increase	1948 annual production	% decrease	1948 annual production
.2	620.8	.8	48.7
1.3	91.2	1.4	334.0
1.9	48.1	2.0	94.8
2.5	229.4	2.0	235.5
3.3	55.5	3.0	79.7
3.5	205.0	3.2	75.6
4.5	72.6	4.3	186.0
5.4	56.2	4.5	72.1
6.0	87.8	6.7	202.0
6.1	152.6	7.5	79.6
7.4	102.5	8.5	153.6
7.4	93.7	9.1	290.7
8.0	127.7	11.2	153.4
8.5	126.3	11.3	53.7
9.0	84.3	12.0	64.2
9.4	101.4	12.6	111.8
10.1	130.8	13.3	183.7
12.2	121.8	14.6	30.4
12.5	193.9	15.8	154.0
14.3	118.7	16.8	70.6
16.8	263.3	19.5	223.0
18.5	83.8	19.9	90.5
18.6	233.8	20.0	42.9
25.3	68.8	23.0	40.5
33.2	94.2	24.5	73.2
46.6	124.9	25.0	70.4
595.3	462.4	25.4	96.4
		26.3	70.8
		26.9	55.7
		27.3	68.9
		30.3	82.8
		32.5	68.5
		36.3	46.0
		39.7	64.3
		41.5	143.8

Table 13. Frequency distribution by changes in production with average size of producing unit and size of total annual milk production of each group for 62 farms in the Kansas City milkshed for 1946-1947.

% change in production	No. of farms	Average size of producing unit (pounds of milk)	Total annual production of each group
+ 10% or more	14	168,400	2,358,000
± 9.9% or less	30	149,800	4,495,200
- 10% or more	18	72.750	1,309,000

Table 14. Frequency distribution by change in production with average size of producing unit and size of total annual milk production for each group for 62 farms in the Greater Kansas City milkshed for 1947-1948.

% change in production	No. of farms	Average size of producing unit (pounds of milk)	Total annual production of each group
+ 10% or more	11	163,000	1,796,400
± 9.9% or less	28	147,000	4,127,400
- 10% or more	23	89,500	2,059,700

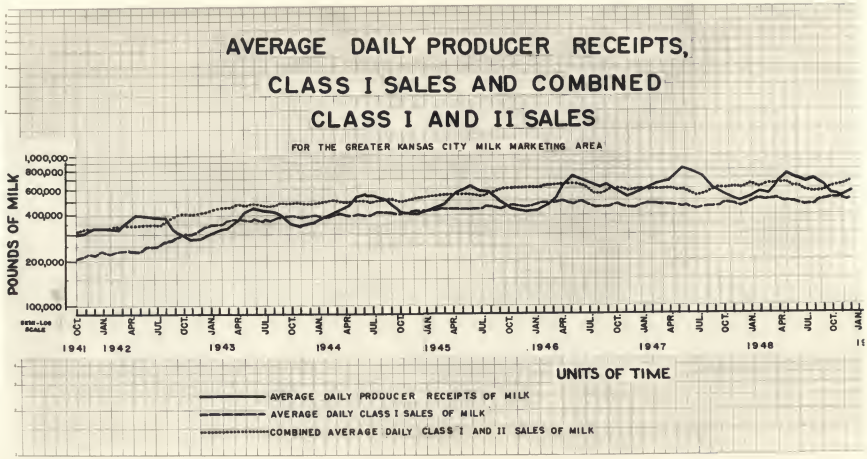

Fig. 20. Semi-log scale chart of average daily producer receipts, Class I sales and Class I and II sales combined in the Greater Kansas City milk market for the period October, 1941 to December, 1948.

Table 15. DAILY AVERAGE OF PRODUCER RECEIPTS, TOTAL CLASS I, CLASS II, AND GRADED CLASS III GREATER KANSAS CITY MILK MARKET

YEAR		JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
1941	Total Prod. Receipts										306223	309689	327977
	Total Class I										215969	225445	227116
	Total Class II										87371	93730	102439
	Total Class I & II										303340	319175	329555
	Graded Class III										30774	21804	28197
1942	Total Prod. Receipts	326676	331967	232952	365423	407061	400629	385789	383245	325221	292656	283727	284362
	Total Class I	232057	229968	235969	238534	239358	249413	251072	264169	282365	299452	303393	321110
	Total Class II	99556	99743	101593	105938	107160	100181	97241	101324	107351	118049	113669	99675
	Total Class I & II	331613	329711	337562	344472	346518	349594	348313	365493	389716	417501	417062	420785
	Graded Class III	28367	35381	26584	51617	90620	79589	64424	43471	1706	437	514	933
1943	Total Prod. Receipts	296885	314111	327968	372832	423405	444422	439610	436594	405669	351855	338734	344451
	Total Class I	347659	357845	365526	385186	377947	385703	379576	377156	397408	400388	408840	399495
	Total Class II	84469	100586	98666	98088	98980	95347	94104	95378	96822	87620	82505	83481
	Total Class I & II	432128	458431	464192	483274	476927	481050	473680	472534	494230	488008	491345	482976
	Graded Class III	1962	2760	3239	10491	18993	25216	25362	23877	3119	624	341	1616
1944	Total Prod. Receipts	367815	393023	418233	454860	533102	553164	547346	530916	489087	425230	422252	414039
	Total Class I	401775	407018	421345	406000	406417	407173	409494	429071	431648	416778	421995	420557
	Total Class II	85044	90557	93507	92925	95522	95460	89831	89389	86607	86050	96088	99873
	Total Class I & II	486819	497575	514852	498925	501939	502633	499325	518460	518255	502828	518083	520430
	Graded Class III	3661	2891	6846	19115	68079	75099	79874	59214	19417	1218	1583	2014
1945	Total Prod. Receipts	432439	450194	468780	544672	608496	647958	598146	580597	505593	448718	441414	423530
	Total Class I	440571	448722	457780	451991	454951	455189	450398	463837	460776	469021	468946	463673
	Total Class II	99392	99471	105299	106026	112383	114665	107471	109581	123744	136671	146296	160482
	Total Class I & II	539963	548193	563079	558017	567334	569854	557869	573418	584520	605692	615242	624155
	Graded Class III	1554	1429	1087	19395	63995	98544	60499	40461	4557	1471	196	294

DAILY AVERAGE OF PRODUCER RECEIPTS, TOTAL CLASS I,
CLASS II, AND GRADED CLASS III
GREATER KANSAS CITY MILK MARKET

YEAR		JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
1946	Total Prod. Receipts	432614	457262	505024	645435	728267	708297	670639	635538	631498	580640	540842	574584
	Total Class I	489637	495676	501485	508122	490610	505521	466950	462794	469691	484094	472476	464810
	Total Class II	144616	148066	147895	*152245	151893	136548	107567	111258	116064	110337	125919	142686
	Total Class I & II	634253	643742	649380	660367	642503	642069	574517	574052	585755	603431	598395	607496
	Graded Class III	388	561	2659	21183	100066	85216	111892	81997	69075	16538	9411	14537
1947	Total Prod. Receipts	597913	628926	655451	709734	830275	804663	770686	650774	596265	565399	511139	509564
	Total Class I	480631	485092	486786	480426	473399	457044	447192	461686	498178	498938	486276	492293
	Total Class II	129244	134255	130815	129252	137090	121161	111463	111986	115442	120583	125513	138614
	Total Class I & II	609875	619347	617601	609675	610489	578205	558655	573672	613620	619521	611789	630907
	Graded Class III	14976	19822	40369	99164	219786	228467	214040	80035	19928	4189	1481	1902
1948	Total Prod. Receipts	522836	563293	558199	660340	750448	694885	*681562	*686762	*632902	*564911	*544537	*568953
	Total Class I	498618	515645	512350	514974	491001	484229	469385	469205	501543	514662	514502	512919
	Total Class II	119730	121732	126997	122596	120741	108602	101543	99381	106387	114291	120000	138096
	Total Class I & II	618348	637377	639347	637570	611742	592831	570928	568586	607930	628953	634502	651015
	Graded Class III	1765	1972	1706	37999	138886	102516	110943	118265	35900	152336	2712	4975

*Preliminary (not audited)